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letter entitled "Shackleton's Contribution to Biogeography" was intended as suggestive rather than positive. Such may be gathered from the opening paragraph. But perhaps some may conclude from it that I view Antarctica as practically the only land connection that has existed between the various continental masses, or between the eastern and western hemispheres; that I consider that faunal and floral elements have ever traveled northward, and have reached the northern continents through the southern from Antarctica as a center of dispersal. This is not the idea that I wish to convey. There have been northward and southward dispersals of types, and eastward and westward dispersals as well. There has certainly been land connection between Eurasia and North America in the Bering region in times past, and many types have passed over that bridge, some going one way and some the other. There are distinctively northern types that have spread southward into the continents of the southern hemisphere, but there are also southern types that have spread northward. There is evidence for believing that the southward dispersals are much more recent than the northward, taken as a whole.

The biogeographical rôle which I conceive Antarctica to have played is that of a center of distribution of the earlier forms of life; and later, perhaps, an exchange ground between the southern continents for old-type stocks, many or some of which traveled northward into the continents of the northern hemisphere. The main point after establishing the Antarctic contacts is to determine the length of their duration with the southern continents. It is quite possible that none of these contacts persisted into Tertiary time, and my suggestion that Africa may have been connected with the southern mass until the Miocene is perhaps wide of the mark. The distribution of certain forms which prompted the suggestion may have to be otherwise explained. It was during Paleozoic and Mesozoic times that I consider Antarctica to have been especially active as a center of dispersal and exchange. I should better have said in my former com-

munication that during Mesozoic (Jurassic to Cretaceous) times the continent was probably not dissimilar to present-day South America and Asia in average elevation; and that its subsequent further uplifting, together with the enormous weight at times of its ice-sheet, which has repeatedly extended and decreased in accordance with changing conditions of altitude and temperature, caused its shelf lines to sink beneath the ocean. Its complete isolation may have been effected before the Tertiary. On the other hand, some of its contacts may have prevailed until the Oligocene. At all events there seems evidence enough to indicate that at one time it played an important part in the dispersal of old-type forms. Doubtless Antarctica is the most remotely ancient of the continents, as indicated by its greatest average elevation.

I am well aware that most European and North American students consider the great majority of distinctively Tertiary and later types to have originated in the northern hemisphere, and I may add that this is also my opinion. But it is well known that, at the beginning of the Tertiary, many types of the higher insects were already in existence, some of which have persisted with little change to the present day. This must necessarily have been the case, since we find their remains scattered through Eocene, Oligocene and Miocene deposits. While evolution has undoubtedly been most active in the development of new types in the northern hemisphere since early Tertiary time, and the prevailing trend of migration has consequently been to the southward, there seems much evidence to indicate that prior to that time the reverse was the case in large part at least.

I shall be glad to see an expression of views on this subject from paleontologists who have made especial studies of various phyla.

CHARLES H. T. TOWNSEND

PIURA, PERU,

September 27, 1910

AMERICAN EDUCATION

TO THE EDITOR OF SCIENCE: The criticisms passed on American education by Mr. Gunn

in your recent issue would be engaging in their frankness, did they not suffer from the vice of banality. It is such a commonplace to start with the premise that this nation is through and through "commercial," and to deduce therefrom the conclusion that our colleges and universities are commercialized, from which, in turn, all the deficiencies of our educational practise are explained. This deductive method, which would now-a-days be dismissed as absurd in the natural sciences, is still the common approach to educational problems, and is precisely the method which must be gotten away from before educational reform can have a scientific basis. Another defect of the author's method is a loose use of such terms as "commercial." Now commerce is at once a gigantic business and a pursuit of gain. In the latter respect it does not differ, to be sure, from other economic activities, yet its name, when used as a tool of deprecation, seems to contain a reference to sordid profits. If, however, the author, and others who talk in the same vein, wish to convey this meaning when they speak of the administration of American colleges as commercialized, they are certainly far afield; for no evidence, as far as I know, has been presented tending to show that presidents and trustees so administer as to make profits for themselves. Probably the author does not mean to include this particular implication of "commercial" when he speaks of college administration, though he does distinctly include it when he turns to apply the term to the student and his aims. As applied to the administration, "commercialized" probably means "desirous of doing big business"; but certainly a more precise characterization of American university administration is necessary before its excellencies can be intelligently strengthened or its vices corrected. As applied to the teaching force of our universities, the author's stock adjectives apparently mean neither that the professor is intent above all things on gain, nor that he is enamored of the ideal of great enterprises, but rather that the atmosphere of American life makes it impossible for him, or

for any one, to enter upon any but commercial pursuits with entire seriousness and enthusiasm. Hence the professor, if naturally energetic, becomes a pedant, or, otherwise, a dilettante; in neither case can he be an inspiring teacher, or rise to true scholarship; in consequence of which the nation's achievements in pure science "have been insignificant." A third defect of the author's method appears in these superlatives and absolute statements, when comparative measures can alone represent the truth or afford a basis and incentive for advance. What we need is the facts, inductively determined, accurately formulated, and if possible put into such shape that quantitative comparisons may be possible between our own conditions and those in more advanced countries, and between our condition now and hitherto as well as hereafter. I have no doubt, however, that such a suggestion will appear to the author as simply one more illustration of that commercial tendency which forms the chief weakness of American education and scholarship—"a disposition to deal with facts and to neglect principles."

R. S. WOODWORTH

COLUMBIA UNIVERSITY,
October 29, 1910

SCIENTIFIC BOOKS

The Laws of Heredity. By G. ARCHDALL REID, M.B., F.R.S.E. London, Methuen & Co. 1910.

Dr. Archdall Reid has already given us books and articles on heredity that are both interesting and instructive, and the present volume not only lives up to the standards set by its predecessors in these particulars, but surpasses them in the breadth of its scope, which is much greater than its title would seem to imply. For not only does the author give an exposition of the laws of heredity and abundantly criticize them, but he discusses at length their bearings, as he sees them, on such sociological questions as eugenics, intemperance, insanity and education, on such psychological problems as the relation of mind to